Worksheet #2.1
You will get a grading slide for this exercise.

1) Describe what you observe when you look at the light in the room with your slide.

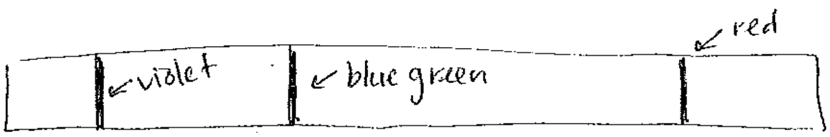
Rainbow of colors, containing light of all wavelengths

Continuous spectrum

2) How does the image in the slide change when you look at the discharge tubes? What is different about the image in the slide based on the different gases? Do you notice any trends?

Write down exactly what you see for hydrogen:

When looking at the discharge tube, only some colors are seen (specific wavelengths). As the atom gets larger (more electrons), more lines are seen in the line spectrum.



3) Using the electromagnetic spectrum in Figure 2.4, write down the approximate wavelengths of the lines you observed for hydrogen.

red line — 657 nm

blue green line — 486 nm

violet line — 434 nm

4) Give a definition for wavelength. How do wavelength and frequency correlate with the energy?

wavelength - distance between two adjacent peaks.

$E \propto \nu$ (directly proportional to frequency)

$E \propto \frac{1}{\lambda}$ (inversely proportional to frequency)

5) Looking at the display of the electromagnetic spectrum (Figure 2.4), write down which electromagnetic radiation is next to the visible light. Which neighbor has the higher and which has the lower energy?

Infrared radiation ← lower energy than visible light

Ultraviolet radiation ← higher energy than visible light

Worksheet #2.2
We will watch videos for this activity.

1) What insight into the atomic structure did Thomson's cathode ray tube experiment provide?

He discoverd the electron showing that atoms are divisible into even smaller particles. He also determined the charge to mass ratio of the electron. $C/m = 1.76 \times 10^8\ C/g$

2) Observe Millikan's oil-drop experiment. How does this experiment complement Thomson's result? What are the conclusions? Calculate the mass of the particle.

Millikan determined the charge of an electron ($1.602 \times 10^{-19} C$).
By using the charge to mass ratio (Thompson) and the charge of the electron (Millikan) we can determine the mass of the electron. $m = \frac{1.602 \times 10^{-19} C}{1.76 \times 10^8\ C/g} = 9.10 \times 10^{-28}$

3) Look at the separation of α, β, and γ rays. Based on these results, what are β rays?

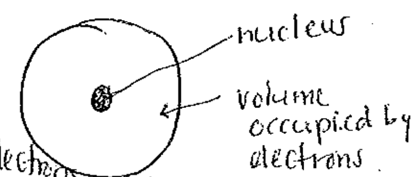
High speed electrons

4) Observe Rutherford's gold foil experiment. What conclusion for the structure of the atom was drawn from it?

Most of the mass of the atom and all of its positive charge reside in a very small, extremely dense region (nucleus).

5) Based on these experiments, what does an atom look like?

- Very small, dense nucleus (most of the mass and all positive charge reside there).
- Most volume is empty space.
- Negatively charged electrons around the outside of the nucleus.



6) If we assume that the electrons are responsible for the line spectra we observed, what conclusion can be drawn?

The electron must reside in one of an array of discrete energy levels or orbits. (the energy of an atom is <u>quantized</u>). An electron may exist only in the available energy levels. The electron may move from one energy level to another by either absorbing or emitting an amount of energy equal to the difference in the energies of the two levels.